

## UltraViolet Spectro-Coronagraph (UVSC) Pathfinder

Completed Technology Project (2016 - 2020)



## Project Introduction

An extensive body of evidence identifies shocks driven by very fast coronal mass ejections (CMEs) beginning within a few solar radii of the Sun as the primary particle accelerators in large, gradual solar energetic particles (SEP) events. These large SEP events are major radiation hazards for astronauts and for spaceborne instrumentation, making a reliable SEP predictive capability a high priority for Heliophysics research. Diverse and extensive lines of evidence indicate that the rapid production of large intensities of high-energy particles is greatly enhanced when the pre-event environment has been primed with a population of suprathermal ions having energies well above the typical thermal particle energy, usually in the range from a few to tens of keV in the solar corona. However, at present we have no direct evidence that suprathermal ions actually exist in the corona in numbers sufficient to serve as "seed particles" for diffusive shock acceleration. The objective of the Ultraviolet Spectro-Coronagraph (UVSC) Pathfinder investigation is to use a new UV coronagraph design concept to make the first remote-sensing measurement of a suprathermal particle distribution in the corona capable of seeding SEP acceleration. Laming et al. 2013, have demonstrated this measurement can be made by an instrument with the UVSC Pathfinder capabilities observing the detailed shape of the H Lyman-alpha resonantly scattered line at coronal altitudes where CME shocks can form (1.8 to 3 solar radii from sun-center). The UVSC Pathfinder investigation was one of 12 experiment concepts selected by the Department of Defense Space Test Program (DOD STP) for the Flight Opportunity Study (FOS) defining the next major STP mission: SPTSat-6. At the conclusion of this FOS, NRL received and provisionally accepted an STP Flight Opportunity Notice (FON) for the UVSC Pathfinder. Subject to the NRL provision, UVSC Pathfinder is currently manifested on the STPSat-6 mission scheduled for launch into geosynchronous equatorial orbit (GEO) in December of 2018. The sole provision NRL placed on accepting the STPSat-6 FON is for UVSC Pathfinder to succeed in the competition for instrument development and science analysis funding under the 2015 H-TIDeS program. The NASA Low Cost Access to Space (LCAS) program is an excellent match for this particular STP opportunity. STP provides integration costs and the launch as well as operation and telemetry costs for one year of operations. The reduced, Level 1 data from UVSC pathfinder will be made publicly available for analysis. Internal NRL/CNR (Chief of Naval Research) funding has been provided for comprehensive trade study and design optimization for this approach to resolving the SEP acceleration science question. The LCAS portion of the effort consists of completion of the UVSC instrument development and support for scientific data analysis by the instrument team. The quality assurance level imposed by STP on UVSC Pathfinder is a tailored Level IV and is equivalent to that of a NASA suborbital mission. Thus, the proposed effort is a complete science investigation (addressing all three overarching Heliophysics science goals) via the construction and spaceflight of innovative, new instrumentation techniques followed by analysis of data, public archiving of data and publication of the results. The complete effort will be conducted in a



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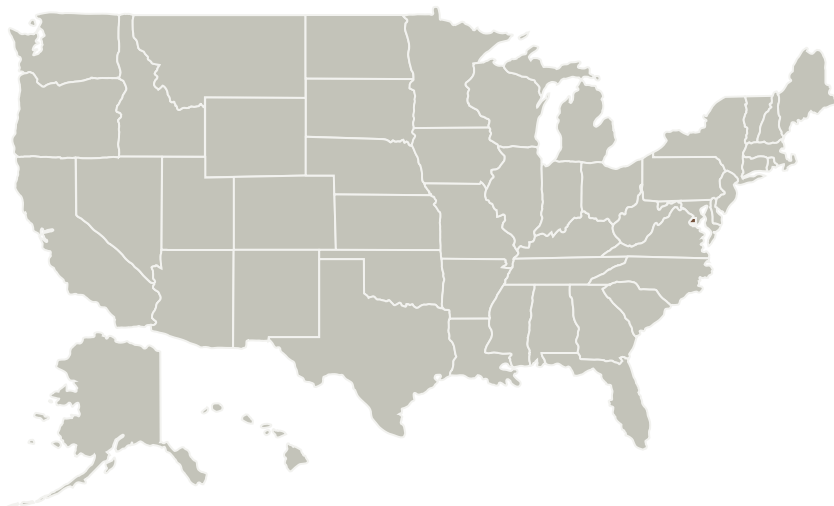
4-year program within an LCAS funding level typical of a new sounding rocket investigation.

### Anticipated Benefits

Support NASA's strategic objectives to understand the Sun and its interactions with Earth and the solar system, including space weather. This will be achieved by developing/demonstrating instrumentation technology necessary to address the following science goals:

- Explore the physical processes in the space environment from the Sun to the Earth and throughout the solar system;
- Advance our understanding of the connections that link the Sun, the Earth, planetary space environments, and the outer reaches of our solar system;
- Develop the knowledge and capability to detect and predict extreme conditions in space to protect life and society and to safeguard human and robotic explorers beyond Earth.

### Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Naval Research Laboratory(NRL)	Lead Organization	US Government	Washington, District of Columbia

### Organizational Responsibility

**Responsible Mission Directorate:**

Science Mission Directorate (SMD)

**Lead Organization:**

Naval Research Laboratory (NRL)

**Responsible Program:**

Heliophysics Technology and Instrument Development for Science

### Project Management

**Program Director:**

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**Program Manager:**

Roshanak Hakimzadeh

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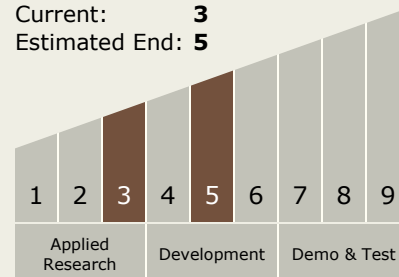


### Primary U.S. Work Locations

District of Columbia

### Technology Maturity (TRL)

Start: **3**  
Current: **3**  
Estimated End: **5**



### Technology Areas

#### Primary:

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
    - └ TX08.1.3 Optical Components

### Target Destination

The Sun